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There has been a suspicion among college English teachers that the writing skills of engineering and science students deteriorate between the time they complete Freshman English and the time they graduate. To test the validity of this hypothesis, 5 groups comprising 361 subjects (72 freshmen, 70 sophomores, 71 juniors, 74 seniors, and 74 technical writing students) at Iowa State University were tested. Each group took 2 free response essay tests and 1 objective test. Scores showed no significant differences in the writing abilities of all 5 groups. A regression analysis was performed to discover the interrelationship of all variables, including earlier test scores, Freshman English grade averages, high school rank, curriculum, and the sequence in which the tests were taken. Correlation between the composite scores and MSAT and ACT total scores was higher than the correlation between composite scores and Freshman English grade averages or the English Placement score. It was inferred that engineering and science students maintain their writing ability between completion of Freshman English and graduation. Because graduate engineers and scientists need very specific writing skills, a senior course should be instituted that is devoted to teaching technical writing and the translation of quantitative thinking and scientific procedures into coherent prose. (Author/JS)

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A PROJECT TO DETERMINE THE PROPER PLACEMENT OF COMPOSITION COURSES WITHIN THE ENGINEERING CURRICULUM

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February 1969

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SUMMARY

This study was conducted at Iowa State University to test the hypothesis that undergraduate engineering and science students deteriorate in writing skills between the time they complete Freshman English and the time they graduate. Five groups comprising 361 subjects (72 freshmen, 70 sophomores, 71 juniors, 74 seniors, and 74 technical writing students) were given 140 minutes of tests. Each subject took two free-response essay tests and one objective test. The means of the composite scores for these tests show no significant difference between the writing abilities of freshmen, sophomores, juniors, seniors, and technical writing students. A regression analysis was performed to discover the inter-relationship of all variables, including earlier test scores, the average of Freshman English grades, high school rank, curriculum, grade point average, and the sequence in which the tests were taken. The correlation between the composite scores and MSAT and ACT total scores was higher than the correlation between the composite scores and the average of Freshman English grades or the English Placement score. It was inferred that engineering and science students do not deteriorate in writing ability between the time they complete Freshman English and the time they graduate. In the opinion of the principal investigator, graduate engineers and scientists need very specific writing skills, which might be inculcated in a senior course devoted to teaching technical writing format and the translation of quantitative thinking and scientific procedures into coherent prose.

INTRODUCTION

The Background of the Problem

For many years there has been a suspicion among teachers of college English that undergraduate engineering and science students, without instruction in expository writing beyond the freshman year, deteriorate in the ability to communicate in writing. This suspicion is based in part on the knowledge that the average engineering or physical science student may, from his earliest school years, have preferred the study of science or mathematics to the study of literature and composition and that many college curricula abet such a student in further narrowing his interests by requiring no more than nine quarter-hours or six semester-hours of instruction in writing and the study of literature.

This impression has also been fostered by employers who imply that their graduate engineers and scientists often do not command the communication skills requisite to the successful performance of their duties. Further support has been given to the hypothesis by a report on a survey conducted by the Joint ECAC Feedback Committee of the American Society for Engineering Education. The survey, based on responses to a questionnaire asking graduate engineers to list their highest subject training needs (seen in retrospect), indicated that most respondents placed Technical Writing second only to Management Practices.[1] The inference made by many English teachers (including the principal investigator on this project) was that, if graduate engineers view training in technical writing as a real need, they probably deem mere Freshman English as inadequate training for the writing tasks confronting them in the post-graduate world.

In this study, the investigator proceeded on the assumption that most engineering students are, despite their keen interest in science and technology, as naturally well-endowed with the ability to write coherent and forceful English prose as are students majoring in the

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[1] Education in Industry: A Study by the Joint Engineering College Administrative Council and the Relations with Industry Division Feedback Committee (Washington, D.C., 1965).

humanities. The assumption was partially generated by an awareness of a study conducted in 1953 by Professor R. P. Weeks of the University of Michigan. Professor Weeks reported that no significant differences were detected between the vocabulary skills, reading speed, and comprehension of a group of one hundred Michigan engineering freshmen and a group of one hundred students of the College of Literature, Art, and Science.[1]

The contradiction between this evidence of fair writing ability in engineering freshmen and the general impression among employers, English teachers, and graduate engineers that people in scientific and technological disciplines have serious writing problems suggested that some circumstance--perhaps an almost exclusive preoccupation with mathematical rather than verbal symbols--diminished language skills between the time a student completed Freshman English and the time he graduated from college.

A Statement of the Problem

Accordingly, it was hypothesized that students majoring in engineering and science need instruction in expository composition at a level beyond that of the freshman year and the completion of the traditional courses in Freshman English--and that expository skills deteriorate between the freshman and senior years in a science-oriented curriculum where the prevailing preoccupation is with mathematical, rather than with verbal, symbols. It was hoped that a series of writing tests, if administered to five groups of students--one group of freshmen, one group of sophomores, one group of juniors, one group of seniors, and one group of juniors and seniors who had completed a course in technical writing--might confirm or deny the hypothesis by making possible a comparison of individual with individual and class with class. If the hypothesis were proven true, the implication would be that engineering and science students sorely needed at least one composition course beyond the freshman complex, probably in the junior or senior year. If the hypothesis were proven false, then the implication would be that some factor other than deterioration is responsible for the

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[1] Edward Foster, "College English for Non-Major Students," College English (May, 1959), 389.

general impression that scientists and engineers cannot write well in line of duty.

Not the least of the difficulties involved in an attempt to confirm or deny the hypothesis was the choice of suitable instruments for testing. The validity of writing tests has long been a bone of contention among educators. Since 1921 the College Entrance Examination Board has sought a means of objectifying graders' judgments of writing samples. In 1945 Noyse, Sale, and Stalnaker reviewed the data from six different one-hour essay examinations and concluded that the reliability of the reading had been too low to satisfy College Board Standards. In 1953 Pearson evaluated an experiment with a two-hour General Composition Test but reported that it was no more reliable than the shorter essay examinations used in earlier years. Eventually it became patent that the unreliability of essay tests stemmed from: 1) the difference in quality of student writing from one topic to another; 2) the different opinions among readers about the characteristics of good writing; and 3) the distortion in values produced by analytical, rather than holistic, reading. The problem of assessing a paper was further complicated by the difficulty of finding a logically sound criterion of composition skills.

Thus the principal investigator for this project was faced with the necessity for finding tests of writing ability that would not be unjustly discriminatory because of the assigned topic's special appeal to the verbally gifted or widely read student; that could be graded according to criteria established for, but not by, the readers; that could be rated according to a holistic, rather than an analytical, reading. At the same time, some means had to be employed for discovering how students varied in particular writing skills (such as organization, the appropriate use of conventions, and critical thinking) according to their year in college, their curricula, their previous training, and their native abilities. It was felt that at least two essay tests (to be graded holistically) and at least one objective test (to yield subscores on specific skills) were required.

RESEARCH PLAN

The Tests

All of the subjects ultimately included in this study took 140 minutes of tests--the Sequential Test of Educational Progress (STEP) Essay Test (Forms 1A and 1C) and the Sequential Test of Educational Progress (STEP) Writing Test (Form 1A).

The Sequential Test of Educational Progress (STEP) Essay Test (Forms 1A and 1C)

The STEP Essay Test, published by the Educational Testing Service, is a free-response test of writing ability. The principal investigator deemed it appropriate to this study because, according to the Educational Testing Service,[1] it is designed to be rated holistically, rather than analytically; because the free responses rated according to models will theoretically result in a significant degree of reliability among readers;[2] and because the writing topics appeared to have a universality of appeal. Thirty-five minutes were allowed for the writing of each essay.

Level 1 of the test was chosen because of its appropriateness to college freshmen and sophomores. Two different forms were used--STEP Essay, Form 1A, and STEP Essay, Form 1C. Every subject on whom data was eventually compiled was required to write both STEP Essay, Form 1A, and STEP Essay, Form 1C. Each version of the test presents a brief paragraph setting forth a topic to write about. (See Appendix A.)

The Sequential Test of Educational Progress (STEP) Writing Test (Form 1A)

Despite its name, the STEP Writing Test is an objective test, made up of 60 multiple choice questions, 30 questions to each of two parts. It is, according to the

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[1] STEP Handbook for Essay Tests, Level 1 (Los Angeles, 1957) 5.

[2] Ibid.

Educational Testing Service,[1] designed to test specific writing skills--namely:

1. Organization (the ordering of ideas).

2. The use of conventions (syntax, sentence structure, diction, punctuation, and spelling).

3. Critical Thinking (detection of unstated assumptions, logical relationships, and anticipation of the reader's needs).

4. Effective presentation (adequacy of emphasis and development; precision and conciseness of expression).

5. The appropriate choice of a level of usage.

This test seemed a particularly appropriate device to incorporate in a program using the STEP Essay Tests, not only because it was conceived to yield sub-scores on specific skills whereas the Essay Tests are designed for holistic reading, but also because (according to the Educational Testing Service) the correlations between Essay scores and Writing Test scores are essentially indistinguishable from the correlations between essay scores.[2] (See Appendix B.) Most of the items on the STEP Writing Test are revision items. Thirty-five minutes were allowed for the completion of each of the two parts.

The Method of Administering the Tests

Every subject was required to attend two testing sessions. At the first testing session the STEP Essay Test, Form 1A, and the first part of the STEP Writing Test were given. At the second testing session, scheduled no less than twenty-four hours after the first session, STEP Essay Test, Form 1C, and the second part of the STEP Writing Test were administered. At each session the order in which the essay test and one part

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[1] STEP Teacher's Guide: Reading, Writing, Listening, Social Studies, Science (Los Angeles, 1959), 46-47.

[2] STEP Handbook for Essay Tests, Level 1 (Los Angeles, 1957), 31.

of the objective test was given was varied, with some students taking the Essay Test first and then the appropriate part of the Writing Test. Other subjects took the appropriate part of the Writing Test first and the Essay Test second.

The Subjects

Between April 25 and October 25, 1968, the two STEP Essay Tests and one STEP Writing Test were administered to 361 Iowa State University students majoring in science or engineering. Twenty-five different curricula are represented, most of which are presumed to be primarily concerned with quantitative, rather than verbal, symbols. (See Appendix C.) Subjects were volunteers, some paid, some recruited by telephone calls, letters, advertising, and appeals to classes.

There were 72 freshmen, 70 sophomores, 71 juniors, 74 seniors, and 74 students who had completed or were about to complete English 414 (the Writing of Reports and Technical Papers). All freshmen had to be in the latter third of their last quarter of Freshman English at the time they took the tests and, in order to be included in the data, had to pass that quarter. (The Freshman English complex at Iowa State totals nine quarter hours.) All sophomores, juniors, seniors, and 414 students had to have completed Freshman English with a passing grade but were not eligible to take the tests if they had taken composition courses beyond the freshman complex. The stipulation that subjects should not have taken additional English courses did not apply to freshmen inasmuch as they are not allowed to take anything but Freshman English.

Although tests were administered to 424 students, 63 of these tests had to be discarded because: 41 subjects did not return to take the second set of tests; 11 subjects had no records of ACT, MSAT, and English Placement scores and no record of high school rank; seven subjects had shifted majors between the time they were contacted and the time they took the tests; two subjects were obviously foreign-speaking; and two subjects had to leave the testing situation before completing their papers. After six months of canvassing engineering and science students for possible subjects, the principal investigator felt further efforts to recruit would be profitless.

Kinds of Data Collected on Subjects

Twenty-two pieces of data were collected on each subject. Part of the data were background facts; the rest were scores on the STEP Essay Tests and the STEP Writing Tests, and the sequence in which these tests were taken.

Background Data

Among those facts relevant to the subjects' background,[1] part or all of the following information was gathered:

1. The subject's major curriculum
2. The average of the subject's grades in Freshman English at Iowa State University
3. The subject's ACT (American College Testing Program) total
4. The subject's MSAT (Minnesota Scholastic Aptitude Test) total
5. The subject's score on the English Placement Test (Cooperative English Test)
6. The subject's high school rank
7. The subject's cumulative grade point average at the beginning of the quarter during which he took the test
8. The subject's grade in English 414 (if any)

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[1] In the original proposal it was suggested that involvement in Iowa State University's on-the-job training program would be considered as a variable, but since less than two per cent of the subjects were so involved, this factor was finally ignored. Also abandoned was the plan to take into account scores on the Senior English Examination. As of June, 1968, the proficiency exam is no longer required of those Iowa State seniors who have earned at least a "C" in each quarter of Freshman English. Thus, only an insignificant number of the subjects would have taken the Senior English Examination.

Scores on the STEP Essay Tests and the STEP Writing Test

The following information was collected about the subjects' performance on tests used in this study:

1. Scores on the STEP Essay tests
   a. Form 1A (three grades, one for each reader)
   b. Form 1C (three grades, one for each reader)
   c. The total of the three scores for Form 1A
   d. The total of the three scores for Form 1C
   e. The total of the totals for Forms 1A and 1C
2. Scores on the STEP Writing Test
   a. Form 1A, Part 1
   b. Form 1A, Part 2
   c. The total of the scores on Part 1 and Part 2
3. The total of the totals, or the composite score, for the STEP Essay Test and the STEP Writing Test
4. The sequence in which the two Essay Tests and the two parts of the Writing Test were taken.

In 329 cases a record was kept of the sequence in which the subject took the two Essay Tests and the two parts of the Writing Test. The object of this record was to determine the fatigue effect of the two types of test--free-response and objective. There were four possible sequences:

1-1 STEP Writing Test, Part 1, first
(at first testing session)

STEP Writing Test, Part 2, first
(at second testing session)

1-2 STEP Writing Test, Part 1, first
(at first testing session)

STEP Writing Test, Part 2, second
(at second testing session)

2-1 STEP Writing Test, Part 1, second
(at first testing session)

STEP Writing Test, Part 2, first
(at second testing session)

2-2 STEP Writing Test, Part 1, second
(at first testing session)

STEP Writing Test, Part 2, second
(at second testing session)

Grading Procedures

Every subject was given a code number, which was written in the upper right-hand corner of the STEP Essay booklets and entered in the identification box on the IBM 1230 answer sheet for the STEP Writing Test. The STEP Writing Test was scored by computer.

The Essay Tests were typewritten in quadruplicate so that one copy, along with the original essay booklet, could be kept in the principal investigator's files and one copy could be distributed to each reader.

Each essay was read by three readers--Mrs. Phyllis Glass, B.S.; Mr. Aubrey Galyon, M.A.; and Mr. Ronald Williams, M.A. Every reader had had at least three years of experience in teaching Freshman English at a state university and was, at the time of the reading, employed as an instructor in English in the Department of English and Speech at Iowa State University.

The essays were graded by the comparison method and given a rating any place from (and including) "1" through "7," with "7" at the high end of the scale. The STEP Handbook for Essay Tests, Level 1 contains models of essays on the topics assigned in Essays 1A and 1C, and the graders were instructed to ignore their own criteria and to match each paper with one of the three models provided (for the ratings "6," "4," and "2") or to place it someplace within range of the models.

Although, according to the Handbook, the readers for the model essays scored papers on the basis of quality of thought (50 per cent), style (30 per cent),

and conventions (20 per cent), they gave no mark other than a number to a paper and thus avoided giving a score that could be precisely analyzed.[1] The readers employed in the project that is the subject of this report were asked to make no marks on the papers and to refrain from discussing essays with other readers.

In order to avoid interference with regular teaching duties, the essays were distributed in three equal batches over a two-month period. Ratings were entered, alongside the appropriate code number, on a score sheet. When all the papers had been read, all three of a subject's scores for Essay 1A were added, all three of his scores for Essay 1C were added, and the total of these two scores was added to the total score for the STEP Writing Test.

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[1] STEP Handbook for Essay Tests, Level 1 (Los Angeles, 1957), 5.

ANALYSIS AND FINDINGS

Method of Analysis

The data collected were subjected to a complete regression analysis in order to 1) compensate for the lack of randomness in the selection of subjects, 2) to yield information about the relative writing skills of the five categories, and 3) to discover the interrelationship of such variables as test scores and the sequence in which the tests were taken, test scores and the subject's curriculum, test scores and Freshman English grades, earlier test scores, high school rank, and grade point average. Also through the regression analysis, the mean score on the Essay Tests was correlated with the mean score on Writing Tests, and the reliability among readers was established. For statistical purposes, curricula were categorized in six large groups. (See Appendix C.)

The plan to break down the Writing Test scores into subscores was abandoned because the reliability estimate was only .72 as computed by KR-20. Since reliability, or measurement accuracy, depends on inter-item correlation and the number of items, it was inferred that any analysis of subscores would be meaningless because of the small number of items in each subscore.

Although the original research design (as detailed in the proposal) implied that the five groups' performances on the essay test would be evaluated through the Chi Square ~~of~~ test of independence, Dr. John W. Menne, the statistician for this project, felt that the regression analysis was a method which would give much more precise measurements than the Chi Square test of independence--particularly with as large a sample as 361 subjects.

Findings

There appear to be no, or only minimally, significant differences in the means of the scores of the five categories (Table 1). Although the Freshman means are either the lowest or among the lowest of those of the various categories, the five-point difference between these means

Table 1. The Means of STEP Essay Tests and STEP Writing Test by Subject Category

Category	Essay 1A	Essay 1C	Essay Total	Writing Part 1	Writing Part 2	Writing Total	Composite
Freshman	11	11.5	22.5	20	19	39	61.5
Sophomore	12	12	24	21.5	21	42.5	66.5
Junior	11	11.5	22.5	22	20	42	64.5
Senior	12	12	24	21	20	41	65
414 Students	12	12	24	21	21	42	66

and those of the Sophomores and 414 Students is probably not highly significant. Similarly, although the Sophomore means are slightly higher than those of any other group, the differences are too slight to be significant. The means of the 414 Students are next highest, but, again, not enough higher to warrant speculation on the cause.

In the regression analysis it was found that the effect of sequence accounts for more of the variance than do either the effect of curriculum or the effect of category (Table 2). Even so, the greater significance of the sequence effect's variance is probably more a function of the large size of the sample than of a meaningful difference.

The means of the significance of the four possible sequences were:

Sequence Number	1 (1-1)	7.03
" "	2 (1-2)	9.51
" "	3 (2-1)	10.77
" "	4 (2-2)	6.23

Thus the mean of the third sequence might indicate that taking the objective test second at the first testing session and first at the second session constitutes a more favorable set of circumstances than any of the other sequences.

There is a significant difference between the means of composite scores of those student who took both parts of the Writing Test second and those who took it first one or both times, but those students who took both parts of the objective test first had only the third highest mean of the possible four.

Key to Table 2

1	Class
2	Curriculum
3	Average of Freshman English Grade
4	414 Grade
5	ACT Total
6	MSAT Total
7	English Placement Score
8	High School Rank
9	Cumulative Grade Point Average
23	Composite Score
24	Year (Category)
25	Year (Category)
26	Year (Category)
27	Year (Category)
28	Curriculum
29	Curriculum
30	Curriculum
31	Curriculum
32	Curriculum
33	Sequence
34	Sequence
35	Sequence

Note: In the first line, the criterion is the composite scores (23), the co-variate is the Freshman English grade (3), and the treatment is the year (24--27). Co-variate 3 accounts for 17.58% of the variance which, with an F-ratio of 76.16 is highly significant statistically, though 17.58% is an expected percentage for this co-variate. Removing the effect of the co-variate leaves the treatment accounting for 2.57% ~~per cent~~ of the criterion variance. This is statistically significant because of the relatively large number of subjects in the study (α ~~0.5~~ .05 level) but 2.57% is such a small percentage of the variance that it is considered meaningless.

Table 2. Regression Analysis Showing Effect of Sequence, Curriculum, and Year

Regression Equations				Co-Variate Analysis		Treatment Analysis			
Cri. Var.	Co-Var.	Treatment	X-Matrix	Multiple R-Square	F-Ratio	Multiple R-Square	F-Ratio	Degrees/ Freedom	Significance
23	3	24 --	27	.1758	76.16	.0257	3.25	4/354	.05
"	5	24 --	27	.0274	10.07	.0376	4.76	4/354	.01
"	6	24 --	27	.1181	47.79	.0500	6.33	4/354	.01
"	7	24 --	27	.1113	44.73	.0216	2.73	4/354	.05
"	8	24 --	27	.1190	48.23	.0323	4.09	4/354	.01
"	9	24 --	27	.1001	39.69	.0211	2.67	4/354	.05
23	3	28 --	32	.1758	76.16	.0111	.99	5/353	-
"	5	28 --	32	.0274	10.07	.0255	2.28	5/353	.05
"	6	28 --	32	.1181	47.79	.0193	1.72	5/353	-
"	7	28 --	32	.1113	44.73	.0292	2.61	5/353	.05
"	8	28 --	32	.1190	48.23	.0187	1.67	5/353	-
"	9	28 --	32	.1001	39.69	.0114	1.02	5/353	-
23	3	33 --	35	.1758	76.16	.0508	4.70	3/355	.01
"	5	33 --	35	.0274	10.07	.0801	7.42	3/355	.01
"	6	33 --	35	.1181	47.79	.0473	4.38	3/355	.01
"	7	33 --	35	.1113	44.73	.0468	4.33	3/355	.01
"	8	33 --	35	.1190	48.23	.0547	5.06	3/355	.01
"	9	33 --	35	.1001	39.69	.0618	5.72	3/355	.01

Of the means of those tests taken by the subjects before, or upon, entering college, those of the ACT and MSAT totals had the highest correlation with the composite scores. Neither the scores on the English Placement Test (1-Cooperative English Test, Single Booklet, Higher, Form T, ETS) nor the average of the Freshman English grades correlated highly with the composite scores. Grade Point Average correlated most poorly of all the co-variates (Table 3).

Table 3. The Correlation of Composite Scores with Co-Variates

Co-Variate	All Subjects	414 Students
Freshman English Grade	.43	.44
ACT Total	.37	.55
MSAT Total	.47	.49
English Placement (1)*	.44	.43
English Placement (2)*	.50	-
High School Rank	-.39	-.40
Grade Point Average	.34	.30
414 Grade	-	.34

* Until September, 1966, I.S.U. Freshmen took the Cooperative English Test, Single Booklet, Higher, Form T, ETS. In September of 1966, this form was replaced by the Cooperative English Test, English Expression, Form 1C, ETS. The designation (1) indicates the earlier test. The designation (2) indicates the later test. Inasmuch as few 414 students had taken the later English Placement Test, the correlation of this variable was not considered relevant.

The correlation between the total score on the Writing Test and the composite score on the Essay Tests was .38--the same as the correlation between the total of the Writing Test and the composite score for Essay 1C (Table 4).

Table 4. Correlation of Means of Essay Tests with Means of Writing Tests

Essay Tests	Writing	Correlation
Composite 1A & 1C	Total, Part 1 & 2	.38
1A	Total	.23
1C	Total	.38
1A	Part 1	.21
1C	Part 1	.34
1A	Part 2	.19
1C	Part 2	.29

The reliability among the three readers of the Essay Tests was found to be .74. By extrapolation (from three readers to two), the ETS readers of the model essays achieved a .6 reliability.[1]

[1] STEP Handbook for Essay Tests, Level 1 (Los Angeles, 1957), 29.

DISCUSSION

This study has disproven the hypothesis that undergraduate engineering and science students deteriorate in writing ability between the time they complete Freshman English and the time they graduate. Although there were slight differences among the means of the five categories, none of them were large enough to be significant. One might conjecture that the rate of attrition among less able engineering and science students tends to maintain the original mean of competence. But such a theory fails to take into account the able students who first choose engineering or science majors but later discover they want to major in one of the disciplines under the humanities.

If the findings of this study are at all representative, some more reasonable explanation must be found for the general impression that graduate scientists and engineers do not write well. There is always the possibility, of course, that, because of their predispositions, students in technological and scientific disciplines graduate and heave a sigh of relief at the prospect of never again having to worry about a squinting modifier or a sentence fragment. But engineers and scientists are often at the helm of important national enterprise. Surely, such people have a concern for the clarity and propriety of their communication.

A much more credible reason for the impression is that the nature of engineers' and scientists' jobs forces them to work and write under pressure--and to write more accurately and frequently than do people in other professions.

Most engineers have many reports to write. Furthermore, in the plant or laboratory, the development of the process or technique is of primary importance, and the description of that process, secondary. Add to the exigencies of a crowded schedule the constant threat of one's training and knowledge becoming obsolete, and the average engineer or scientist is confronted with the necessity for reading assiduously, researching exhaustively, and reporting perfunctorily.

His problem is compounded by the fact that, not only must he write under pressure, but he must write <u>with an intimidating degree of accuracy</u> under pressure. Without question, his writing must be more precisely adapted to

practical application than the writing of an English teacher or sociologist--the consequences of a specification for a "fastener" rather than a "10-32-NF threaded stud and nut" can be catastrophic to an astronaut dependent for his life upon the smooth functioning of his spaceship. And certainly, there is more immediately at stake in a report on a craft's airworthiness than in an evaluation of a proposed new textbook or a survey of community attitude toward low-income housing.

Thus the responses to the joint ECAC Feedback Committee's questionnaire may be assumed to mean exactly what they say--that graduate engineers wish they had had more technical writing as undergraduates. They do not, apparently, wish they had had more general composition. They have evidently found in their post-graduate experience that they need instruction in a very special kind of writing. What they failed to get in college, perhaps, was a course that would enable them to write a report without spending hours deciding how best to organize facts, display data, and adopt the right tone for the intended reader. Those who had a course in technical writing may have considered it inadequate because it was taught as just another general composition course and too little time was spent in training students to translate scientific logic--sometimes instinctual and often unverbalized--into sentences and paragraphs which replicate for the reader the actual sequence of the investigator or expediter's ideas. Such a course--placed in the senior year and including problems in organization, format, and precision of expression--might arm the engineer or scientist with enough automatic responses to make writing under pressure a more mechanical and therefore less time-consuming process.

Other findings derived from the study are no more positive but, at the same time, no less generative of speculation about the effects of particular variables on a subject's performance on writing tests.

The regression analysis indicates that the means of those tests usually considered to be tests of general academic ability correlate more highly with the means of the tests used in this study than do the means of tests and other criteria for specific language skills. For all the subjects considered, the mean of the MSAT totals correlates with the mean of composite scores at .47. For the 414 students, the mean of the ACT totals correlates with the mean of composite scores at .55. For all subjects and for 414 students, the means

of the average of Freshman English grades correlate with composite scores at .43 and .44. For all appropriate subjects, the mean of the scores on the English Placement Test used first at I.S.U. (Cooperative English Test, Single Booklet, Higher, Form T, ETS) correlates with the mean of composite scores at .44, although the mean of the scores on the English Placement Test now used at I.S.U. (Cooperative English Test, English Expression, Form 1C, ETS) correlates at .50 with appropriate subjects' composite scores. One possible conclusion from these findings is that tests of general ability may be more carefully standardized than tests of specific skills.

The regression analysis indicates that the mean of cumulative grade point averages correlates with the mean of the composite scores at only .34. This correlation may suggest that engineering and science students have neither the motivation nor background for doing as well in composition tests as they do in tests on subject matter which seems more relevant to their interests and goals. (For example, a typical electrical engineering student might concern himself more with getting an "A" in a mathematics course than in an English course.)

The analysis further suggests that the effect of a particular curriculum upon writing ability is negligible. On the other hand, there is a significant difference between the means of composite scores of those students who took both parts of the Writing Test second and those who took it first one time or both times. This difference might be construed to mean that the fatigue-effect of writing an essay is greater than the fatigue-effect of taking an objective test--were it not for the fact that those students who took both parts of the objective test first had only the third highest mean of the possible four. The highest mean related to sequence was that of the group which took the objective test second at the first session and first at the second session. Because the directions for taking the objective Writing Test are somewhat complicated, the subjects may have derived an advantage from taking it first at the second session, when the memory of the proper procedure was relatively fresh in their minds and they had reference, not only to the proctor's instructions, but to their own experience.

The appropriateness of the tests chosen for the study might seem to be called into question by the earlier discussion of the kinds of writing ability needed by engineers and scientists. But the original hypothesis was that certain kinds of undergraduates deteriorated in unspecified

writing skills--not that they deteriorated in technical writing ability. Hence, the tests chosen may be said to be appropriate to the situation.

The Handbook's claim that the correlations between Essay scores and objective Writing scores "are essentially indistinguishable from the correlations between two Essay scores"[1] was partially validated. A check on the mean of composite scores on the Essays and the mean of total scores on the objective test reveals a .38 correlation, as does a check on the mean of the total scores on Essay, 1C, and the mean of the total scores on the Writing Test. The correlation between the means of the total scores for the two essays was .40. But the correlation between the mean of the total scores on Essay, 1A, and the mean of the total score for the Writing Test was only .23.

The comparison method of rating the essays proved to be a fortunate choice for this project. The reliability of the three readers (Mrs. Phyllis Glass, Mr. Aubrey Galyon, and Mr. Ronald Williams) was .74. According to the Handbook, the intra-class correlation of the readers of the model essays was only .50 for both Essay 1A and Essay 1C.[2] But the standardization program for Level 1 essays provided for only two readings of each paper by 197 and 226 examinees for Essays 1A and 1C respectively. The higher reader reliability on this study may also be due to the fact that teachers of Freshman English at Iowa State University annually attend a grading seminar, at which common criteria are discussed. While the I.S.U. readers used in this study were enjoined to employ the model essays as criteria, rather than their own standards, they may have found that, as a result of accepting departmental criteria in their usual grading practices, it was easier to conform to the Handbook's explicit directions.[3]

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[1] STEP Handbook for Essay Tests, Level 1 (Los Angeles, 1957), 31.

[2] STEP Handbook, 29.

[3] In a study of the grading methods of the Iowa State Department of English (March, 1968), Dr. John W. Menne, the statistician for this project, found a .84 reliability among teachers of Freshman English. Dr. Menne made no inference about instructor bias in rating various skills but found that the instructors' method of deriving course grades from an evaluation of specific skills was consistent.

Although it was disappointing to find the reliability of the STEP Writing Test too low to warrant use of the subscores for detecting weaknesses and strengths in specific skills, the lack of significant differences in the means (of the composite scores) of the five categories makes the lack of subscores a negligible defect in the study. Had there been a significant difference in composite scores, however, the lack of subscores might have been a serious deterrent to completing the study.

APPENDIX C

Subjects by General Area and Specific Curriculum

General Area	Specific Curriculum	Number of Subjects
Agricultural	Agricultural Engineering	13
Civil	Aerospace Engineering	35
	Architecture and Architectural Engineering	28
	Building Construction	5
	Ceramic Engineering	13
	Civil Engineering	29
	Mechanical Engineering	52
Chemical	Chemical Engineering	36
Electrical	Electrical Engineering	41
Engineering-Operational	Engineering Operations	23
	Engineering Technology	1
	Engineering Science	2
	Industrial Engineering	19
Scientific	Bacteriology	1
	Botany	1
	Biochemistry	1
	Chemistry	12
	Computer Science	1
	Forestry	4
	Geology	7
	Mathematics	17
	Metallurgy	3
	Physics	9
	Science	5
	Zoology	3

REFERENCES CITED

Education in Industry: A Study by the Joint Engineering College Administrative Council and the Relations with Industry Division Feedback Committee (Washington, D.C., 1965).

Foster, Edward. "College English for Non-Major Students," College English (May, 1959), 384-90.

STEP Handbook for Essay Tests, Level 1. Princeton, N.J.; Los Angeles 27, Calif.: Cooperative Test Division, Educational Testing Service, 1957.

STEP Teacher's Guide: Reading, Writing, Listening, Social Studies, Science. Princeton, N.J.; Los Angeles 27, Calif.: Cooperative Test Division, Educational Testing Service, 1957.